

Detection and characterization of dispersive North Atlantic Right whale up calls in a shallow-water environment using a region-based active contour model

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Abstract

For mitigation and monitoring of endangered North Atlantic Right whales, identifying their presence from their vocalisations is the essential principle of *Passive Acoustic Monitoring (PAM)* system. The most common vocalisations of Right whales are characterized as frequency modulated up sweeps with duration of ~ 1 s and a frequency range from 50 to 200 Hz. These species favour shallow waters during their seasonal migration. Such shallow-water acoustic environments act as a waveguide and cause the mono-component up call emitted by the vocalising whale to become a dispersive multi-mode signal with different time arrivals and relative energy at the receiver. As well as the natural variation in species vocalisation, another variation in the characteristic features extracted from dispersive calls results from the dispersion effect.

In this thesis normal mode modelling was used to better understand the influence of shallow water on the parameters of Right whale up calls. Also, examples from data recorded in Cape Cod Bay shows the dispersion influence. Visual scanning indicates that 93% of the data are dispersive and the first mode in 85% of these calls is less excited than the second mode due to the dependence of mode excitation on the depth of the calling whale.

The discrimination between the Northern Right whale up calls and background noise has been investigated using the Support Vector Machine classifier. To perform this task, a region-based active contour segmentation method is proposed. This approach is based on the evolution of the contour within the spectrogram image searching for the uniformity of the target object. In this work both synthesized data based on typical Right whale vocalisations and real data recorded in Cape Cod Bay are used to evaluate the proposed method.

To illustrate the variation in the data caused by the channel effect we compare the descriptive statistics of the call duration using both the single mode and the multi-mode approaches. The single mode analysis was performed by extracting the frequency contour of the first mode.

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DECLARATION STATEMENT

(Research Thesis Submission Form should be placed here)